REMARKS

Claims 1-8 have been rejected by the Examiner under 35 U.S.C. § 102(b) as being anticipated by Zapka et al., (WO 01/36202 A1). This rejection is respectfully traversed.

The present invention is directed to a method of controlling an inkjet printhead containing a substantially closed duct in which ink is situated, in which the duct has at least one exit opening for the ink, wherein an actuation pulse is applied to an electrode-mechanical transducer so that the pressure in the duct changes in such a manner that an ink drop is ejected from the exit opening, measuring the electrical impedance of the electro-mechanical inducer during the application of the actuation pulse and adapting the actuation pulse on the basis of the measured impedance.

In the course of the printing process, not only will the material properties and particularly the expansion characteristic of the electro-mechanical transducers slowly change, but also the mechanical construction itself is also subject to change. This results in the fact that a specific actuation pulse will come in the course of time, give a different drop ejection which results in a decline in characteristics. The present invention makes use of the realization that the electrical impedance of the electro-mechanical transducer is dependent on the same parameters as those that determine the pressure change in a duct as a result of a specific actuation pulse. And accordingly, the present invention contains the steps of measuring the electrical impedance of the electromechanical transducer during the application of the actuation pulse and adapting the actuation pulse on the basis of the measured impedance.

As explained in paragraphs 28 and 29 of the present specification, the impedance can be measured real-time (page 11, fourth line), thus enabling real time adjustment of the actuation

pulse itself while it is applied (see page 11, paragraph 29, first three lines). Thus, as noted on page 11 of the present application, using the incoming signals, the unit 13 can measure in real time the current/voltage characteristic of the transducer. Thus, using the closed loop control, it is possible to update the actuation pulse in real time in order to achieve the desired effect at all times.

Zapka et al. disclose a method to enable adjusting the actuating electrical signals for an electromechanical transducer of an inkjet print head, in order to compensate for temperature changes over time. Zapka et al. teaches, certain essential properties of the ink, such as viscosity, and change in dependence of the ink temperature. Zapka et al. discloses that the impedance of at least a portion of the actuator can be measured in order to derive a signal indicative of the temperature of the ink. This information can then be used in order to adjust the electric drive signals of the piezo-electric actuator.

Indeed, the Zapka et al. teaching may be suitable to monitor the temperature of the ink during printing. The ink temperature is a relatively slowly varying parameter, i.e., the ink temperature changes as a result of heat generated in the actuator control circuit, which heat will dissipate to the actuator where, on it's turn will warm up the ink (see page 11, lines 22-30). Zapka et al. has devised a measuring circuit that can detect the temperature changes of the ink such that subsequent actuator pulses can be adjusted to the measured temperature.

A very important disadvantage of the Zapka et al. method is that it is not suitable to detect local swift changes during the application of an actuation pulse at the ink channel itself, and immediately adapt yet the same actuation pulse to these local swift changes. The Applicants have recognized that there is a need for a detection method that enables responding to very rapid

changes at the ink channels (e.g. cross-talk, sudden appearance of small air bubbles, etc.), such tat even actuation pulses which are in the process of being applied can be adjusting during the application itself.

Toward this end, the method according to the present invention has been developed. This method enables the real time measurement of the impedance of an electromechanical transducer during the application of a pulse, and real time adapting the same pulse on the basis of this measurement.

This method provides the possibility to adapt a pulse that has already been started (as already known from Zapka et al., pulses take some time to be completed (see Figure 4 of the Zapka et al. reference), to sudden local changes at the ink channel, even if these changes take place during the application of that particular pulse. In Figure 1, a particular embodiment is described that enables real time measurement and adjustment. As can be understood from Figure 1 and the accompanying description, a closed loop control arrangement is provided that enables the real time adjustment of an actuation pulse while it is being applied. The Zapka et al. reference is completely silent about a real time closed loop control arrangement for adapting pulses while they are being applied. Further, it is clear that the Zapka et al. reference does not even hint at the method of the present invention simply because the problem underlying the present invention is not recognized by Zapka et al.

The advantage of the present method over the Zapka et al. method is clear. With the method according to the present invention it is possible to determine any parameter that influences the drop ejection process (being either slowly varying parameters or quickly varying parameters, i.e. parameters that vary within the time period that corresponds to the length of a

pulse), such that pulses can be adjusted while they are being applied. This provides the possibility to rule out any negative influence of these parameters on the drop ejection process (see paragraph 29 of the present invention).

In short, it is clear that the method and apparatus according to the present invention are novel and non-obvious over the Zapka et al. reference.

Accordingly, in view of the above amendments and remarks, reconsideration of the rejection and allowance of the claims of the present application are respectfully requested. In the event that the proposed amendment does not place the present application into condition for allowance, entry thereof is respectfully requested as placing the present application into better condition for appeal.

If the Examiner has any questions or comments, please contact the undersigned at the offices of Birch, Stewart, Kolasch & Birch, LLP.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17; particularly, extension of time fees.

Dated: December 13, 2005

Respectfully submitted,

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